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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/519,724	LAERMER, FRANZ	
	Examiner	**Art Unit**	
	RAKESH DHINGRA	1716	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 February 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 December 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date ____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 14-28 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 14, 18, 20 by adding new limitations e.g. in claim 14 new limitation like "the gas supply means including a first mass flow regulator configured to regulate the first gas to a first flow rate to the plasma reactor, and a second mass flow regulator configured to regulate the second gas to a second flow rate to the plasma reactor, wherein the first flow regulator and the second flow regulator are configured to regulate the respective first and second flow rates to provide an ideal stochiometric conversion of the first gas and the second gas to chlorine trifluoride" has been added. Further applicant has added new claims 29-31.

Accordingly claims 14-31 are now pending and active.

Applicant's Admitted Prior Art (AAPA hereinafter) when combined with Walter et al, Suto et al and Yanagisawa et al reads on limitations of amended independent claims 14, 20, 27 and newly added independent claim 29. Accordingly, claims 14, 16-22, 27, 29 and 30 have been rejected under 35 USC 103 (a) as explained below. Balance claims 15, 23-26, 28 and 31 have also been rejected under 35 USC 103 (a) as explained below.

Further response to applicant's arguments is given hereunder.

<u>A) Rejection of claims 14, 16-19 under 35 USC 103 (a)</u>

1) Regarding applicant's traversal of inherency of production of ClF_3 in Suto's apparatus, examiner responds that the new grounds of rejection of claim 14 include teaching of Walter which does teach generation of ClF_3 (besides ClF_5) {col. 3, lines 4-44}.

2) Applicant further argues that the apparatus and base gases disclosed in Walter et al. differ substantially from the disclosure of Suto et al. Thus, the purported generation of chlorine trifluoride in Walter et al. does not in any manner establish or support any contention that chlorine trifluoride would *necessarily* be generated under the conditions disclosed in Suto et al.

Examiner responds that Walter teaches that ClF3 could be produced under glow discharge using chlorine and fluorine containing gases. Walter also teaches controlling flow rate of gases, pressure etc to control glow discharge. Further, Suto et al teaches high density plasma apparatus using chlorine and fluorine containing gases, that generates interhalogen molecules like ClF. It would be obvious to control pressure, flow rates of gases etc to obtain high density plasma discharge with generation of ClF3, in the apparatus of AAPA in view of Walter, Suto and Yanagisawa, in view of teaching of Walter. Thus the apparatus of AAPA in view of Walter, Suto and Yanagisawa is considered capable of generating ClF3.

3) Applicant further argues that Suto does not disclose first and second mass flow regulators to provide an ideal stochiometric conversion to ClF3, nor there is any appararent reason to modify the respective flow rates.

Examiner responds that Walter et al teach that fluorine is present at least in stochiometrical amounts for production of ClF5 {e.g. col. 1, line 40 to col. 4, line 55). Walter also teaches that generation of ClF5 does take place when chlorine and fluorine atoms are excited together, irrespective of their relative concentrations. It would be obvious to excite chlorine and fluorine atoms together to produce ClF5 (and also ClF3), and further, since Yanagisawa teaches gas flow regulators 34-36, it would be obvious to control the amounts of both fluorine and chlorine (or regulate their flow rates) to obtain an optimized or ideal

stochiometric conversion to ClF5. Further, since the apparatus of Walter et al also generates ClF3 (besides ClF5) it would be obvious to control flow rates of first and second gases in the apparatus of admitted prior art in view of Walter, Suto and Yanagisawa to obtain optimized stochiometric conversion of these gases to ClF3 and obtain benefit of increased etching rates of silicon substrates. Thus the apparatus Admitted prior art in view of Walter, Suto and Yanagisawa teaches all limitations of claim 14 and is considered capable to generate ClF3.

4) Regarding claim 19, the applicant contends that the analysis in the Office Action that "claim limitation pertaining to generation of gaseous chlorine trifluoride is an intended use limitation, and since the prior art apparatus meets all of the structural limitations of the claim, the same is considered capable of meeting the intended use limitation.", is improper Applicant again notes that this analysis is improper since the referenced claim recitation is not an intended use limitation as indicated, and, further, functional limitations must be considered and evaluated just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used.").

Examiner responds that the apparatus of AAPA in view of Walter, Suto and Yanagisawa teaches all structural limitations of the claim as explained in the office action. Further, as explained above, since the prior art apparatus of AAPA in view of Walter, Suto and Yanagisawa is considered capable of generating ClF3, the apparatus of prior art teaches the functional limitation "exposed to gaseous ClF3".

B) Rejection of claim 15 under 35 USC 103 (a)

Applicant argues that the combination of Suto, Yanagisawa and Ye does not disclose or suggest all features of the claim, since Ye or the combination does not teach features of claim 14, and therefore the rejection may be withdrawn.

Examiner responds that as already indicated above the prior art apparatus of Admitted prior art in view of Walter, Suto and Yanagisawa teaches all limitations of claim 14. Further Ye teaches limitations of additional limitations of claim 15. Thus the combination of admitted prior art in view of Walter, Suto, Yanagisawa and Ye teaches all limitations of claim 15.

C) Rejection of claims 20-26 under 35 USC 103 (a)

Regarding applicant's traversal of inherency of production of $ClF3$ in Suto's apparatus, examiner responds that the new grounds of rejection of claim 14 include teaching of Walter which does teach generation of $ClF3$ (besides $ClF5$) {col. 3, lines 4-44}. Regarding applicant's further argument that the combination of Suto et al., Yanagisawa et al., and Walter et al. does not disclose, or even suggest, regulation of gas flows of first and second gases to provide an ideal stochiometric conversion of the first gas and the second gas to chlorine trifluoride, examiner responds that as also explained below under claim rejections, Walter et al teach that fluorine is present at least in stochiometrical amounts for production of $ClF5$ {e.g. col. 1, line 40 to col. 4, line 55). Walter also teaches that generation of $ClF5$ (and also $ClF3$) takes place when chlorine and fluorine atoms are excited together, irrespective of their relative concentrations. It would be obvious to excite chlorine and fluorine atoms together to obtain optimized production of $ClF5$ (and also $ClF3$). Further since Yanagisawa teaches gas flow regulators 34-36, it would be obvious to control the amounts of both fluorine and chlorine (or regulate their flow rates) to obtain an optimized or ideal stochiometric conversion to $ClF5$. Further, since the apparatus of

Walter et al also generates ClF3 (besides ClF5) it would be obvious to control flow rates of first and second gases in the apparatus of admitted prior art in view of Walter, Suto and Yanagisawa to obtain optimized stochiometric conversion of these gases to ClF3 and obtain benefit of increased etching rates of silicon substrates. Thus the combination of AAPA in view of Walter, Suto and Yanagisawa teach all limitations of claim 20, and dependent claims 21, 22 and also dependent claims 23-26.

D) Rejection of claim 27 under 35 USC 103 (a)

Response to applicant's arguments regarding inherency and selecting ratios of first and second gases to achieve ideal stochiometric conversion to ClF3 is already given under claim 20. Applicant has further argued that the applicant disagrees with the assertion at page 13 of the Office Action that "it would be obvious to select the ratio of the first gas flow to the second gas flow to achieve an ideal stochiometric conversion to chlorine trifluoride" in view of Walter et al. Firstly, there is no apparent reason to achieve an ideal stochiometric conversion to chlorine trifluoride in either of Suto et al or Walker et al. Indeed, chlorine trifluoride is described as one of several by-products from which the desired chlorine pentafluoride separated. See col. 1, lines 53 to 58. Moreover, Walter et al. teaches that "the concentrations of [fluorine and chlorine] atoms should be such that the fluorine is present at least in stoichiometrical amounts for the production of ClF5, and preferable there should be an excess of fluorine" (emphasis added), thereby teaching away from providing an ideal stochiometric conversion to chlorine trifluoride. Thus, the present rejection is deficient for at least this additional reason.

Examiner responds that Walter teaches generation of ClF3 (besides ClF5) {col. 3, lines 4-44}. Walter et al further teach that fluorine is present at least in stochiometrical amounts for

production of ClF5 {e.g. col. 1, line 40 to col. 4, line 55). Walter also teaches that formation of ClF5 does take place when chlorine and fluorine atoms are excited together, irrespective of their relative concentrations. It would be obvious to excite chlorine and fluorine atoms together to produce ClF5, and further control the amounts of both fluorine and chlorine (or their ratio) to obtain an optimized or ideal stochiometric conversion to ClF5. Further, since the apparatus of Walter et al also generates ClF3 (besides ClF5) it would be obvious to control flow rates of first and second gases in the apparatus of admitted prior art in view of Walter, Suto and Yanagisawa to obtain optimized stochiometric conversion of these gases to ClF3 and obtain benefit of increased etching rates of silicon substrates. Though Walter teach that preferably there should be an excess of fluorine, but keeping in view Walter's teaching that for optimum yields fluorine should be present at least in stochiometric amounts, it would be obvious to optimize the amounts of fluorine and chlorine to obtain Walter's stated objective of obtaining optimum yields, i.e. to achieve ideal stochiometric conversion to ClF5 (and ClF3 to obtain enhanced etching rate of silicon substrate). Thus, Walter does not teach away from providing an ideal stochiometric conversion to ClF3. In view of above the combination of admitted prior art in view of Walter, Suto and Yanagisawa teach all limitations of claim 27. Further in view of above the combination of admitted prior art in view of Walter, Suto, Yanagisawa and Yamazaki teaches limitations of claim 28.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter

sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 14, 16-22, 27, 29, 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted prior art in view of Walter et al (US 3,354,646), Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) and Yanagisawa et al (US PGPUB No. 2001/0007275).

Regarding Claims 14, 16: Admitted prior art teach a method and apparatus that discloses benefit of using ClF3 for etching silicon substrates (Applicant's specification – page 1, lines 10-20).

Admitted prior art does not teach a device for generating ClF3 comprising: plasma generating means for generating a high density plasma in the plasma reactor, and also do not teach the gas supply means including a first mass flow regulator configured to regulate the first gas to a first flow rate to the plasma reactor, and

a second mass flow regulator configured to regulate the second gas to a second flow rate to the plasma reactor,

wherein the first flow regulator and the second flow regulator are configured to regulate the respective first and second flow rates to provide an ideal stochiometric conversion of the first gas and the second gas to chlorine trifluoride.

Walter et al teach an apparatus for generating chlorine trifluoride using plasma glow discharge having spaced electrodes (which would obviously use a plasma reactor) using a first

gas (F2) and a second gas (Cl2) which gases react with one another under the influence of plasma discharge to generate ClF3 (besides ClF5). Walter et al further teach that besides other factors, relative concentrations of fluorine and chlorine atoms are controlled to obtain glow discharge. Walter also teaches that formation of ClF5 does take place when chlorine and fluorine atoms are excited together, irrespective of their relative concentrations{e.g. col. 1, line 40 to col. 4, line 55).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to regulate the process parameters like pressure and flow rates of first and second gases as taught by Walter et al in the apparatus of admitted prior art to obtain glow discharge and generate ClF3 to obtain enhanced etching rate of substrates.

Walter et al do not teach plasma generating means generate high density plasma in the plasma reactor, and also do not explicitly teach the gas supply means including a first mass flow regulator configured to regulate the first gas to a first flow rate to the plasma reactor, and

a second mass flow regulator configured to regulate the second gas to a second flow rate to the plasma reactor,

wherein the first flow regulator and the second flow regulator are configured to regulate the respective first and second flow rates to provide an ideal stochiometric conversion of the first gas and the second gas to chlorine trifluoride.

Suto et al teach a microwave plasma (high density plasma) etching apparatus (shown in Figure 1) for processing wafers comprising a plasma reactor (quartz tube) with gas supply means including a first gas (NF3) and a second gas (Cl2) selected to react with the first gas under the influence of high density plasma, and the gases are supplied to the plasma generating chamber

(quartz tube) for carrying out etching on a silicon wafer. Suto et al further teach that etching is based upon the microwave plasma generated species of fluorine and chlorine that are supplied to a reaction chamber via a gas outlet. Suto et al also teach that during plasma discharge, F and Cl atoms and inter-halogen FCl molecules are generated which are then transported into the reaction chamber (e.g. Fig. 1 and pages 2032-2034). Since Suto teaches production of interhalogen ClF during the process, few molecules of ClF3 would also be produced during the process, considering the teaching of Walter et al that ClF3 could be produced under glow discharge conditions. It would be obvious to generate ClF3 in the apparatus of AAPA in view of Walter et al and Suto et al by controlling factors for producing glow discharge like pressure, rate of flow of gases as per teaching of Walter et al. Thus the apparatus of AAPA in view of Walter et al and Suto et al is considered capable of generating ClF3 under high density plasma. It is noted that Suto et al uses similar gases viz. Cl2 and NF3 as also used by the applicant to produce ClF3.

Further, the applicant has invoked 35 USC 112 sixth paragraph in respect of claim limitations a) "plasma generating means" as included in specification at page 11, lines 10-37 {including a microwave waveguide 150, magnetron 170, terminator 180, circulator 160, tuner 155).

Still further, claim limitation “gas supply means (21, 22, 25) -------------to chlorine trifluoride” is not considered to invoke 35 USC 112 sixth paragraph since the limitation includes relevant structure, and thus does not meet prong “C” of the 3-prong analysis [MPEP 2181].

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use high density plasma generation means as taught by Suto et al in the apparatus of

admitted prior art in view of Walter et al to generate ClF3 and obtain enhanced etching of silicon substrate.

Admitted prior art in view of Walter et al and Suto et al do not explicitly teach a) the plasma generating means include microwave waveguide 150, magnetron 170, terminator 180, circulator 160, tuner 155), and b) the gas supply means including a first mass flow regulator configured to regulate the first gas to a first flow rate to the plasma reactor, and

a second mass flow regulator configured to regulate the second gas to a second flow rate to the plasma reactor,

wherein the first flow regulator and the second flow regulator are configured to regulate the respective first and second flow rates to provide an ideal stochiometric conversion of the first gas and the second gas to chlorine trifluoride.

Though Suto et al teach high density plasma generating means comprising of a microwave plasma apparatus but do not explicitly teach details of the same like waveguide, tuner, terminator etc. However use of microwave plasma apparatus for plasma etching and comprising waveguide, tuner, terminator etc and gas bottles and mass flow regulators is known in the art as per reference cited hereunder.

Yanagisawa et al teach a plasma apparatus (Figure 1) comprising:

A discharge tube 2 (plasma reactor) with plasma generating means (including magnetron 10, waveguide 11 (hollow conductor) with tuner 14, isolator (normally includes circulator) 15 and reflection plate (terminator) 13, by which plasma can be generated in the discharge tube 2 and gas supply means including gas bombs 31, 32, 33. Yanagisawa et al also teach gas flow regulators (controllers) 34, 35, 36 that can be adjusted to control flow rates of the first and the

second gas supplied to the discharge tube 2 (plasma reactor), and reactive species generated due to reaction of two gases under high density plasma, are supplied to the process chamber via the gas pipe 20 at its outlet 20a (Fig. 1 and para. 0044-0053, 0072). It would be obvious to provide the plasma generating means of AAPA in view of Walter et al and Suto et al with items like waveguide tuner, terminator, circulator etc and the gas flow regulators for the first and the second gases as taught by Yanagisawa et al as known means for use in microwave plasma apparatus for generating high density microwave plasma. Further, since Walter et al teach that besides other factors, relative concentrations of fluorine and chlorine atoms are controlled to obtain glow discharge, and that formation of ClF5 does take place when chlorine and fluorine atoms are excited together, irrespective of their relative concentrations, and still further that fluorine is present at least in stochiometrical amounts for production of ClF5 (including ClF3) {e.g. col. 1, line 40 to col. 4, line 55), it would be obvious to regulate flows of both fluorine and chlorine containing gases to obtain optimized (stochiometric) conversion of these gases to form ClF5. Further, since apparatus of Walter et al also generates ClF3 (during generation of ClF5) it would be obvious to regulate flow rates of first and second gases by the first and second gas flow regulators to obtain optimized stochiometric conversion of these gases to ClF3 and obtain increase etching rates of silicon substrates. Thus the prior art apparatus of Admitted prior art in view of Walter et al, Suto et al Yanagisawa et al meets all the structural limitations of the claim, and is considered equivalent to the applicant's disclosed apparatus, and the same is considered capable of generating chlorine tri-fluoride as claimed (when the structure recited in the reference is substantially identical to that of the claims, claimed functions are presumed to be inherent – MPEP 2112.01) .

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide plasma generating means comprising items like tuner, terminator, circulator etc and the gas supply means comprising first and second gas flow regulators as taught by Yanagisawa et al in the apparatus of AAPA in view of Walter et al and Suto et al as known means for use in high density (microwave) plasma generating apparatus.

In this connection courts have ruled:

The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945)

Additionally, claim limitations "device for generating chlorine trifluoride", "to form chlorine trifluoride" and "formed chlorine trifluoride" are intended use limitation, and since the prior art apparatus meets all the structural limitations of the claim, the same is considered capable of meeting the intended use limitation.

In this connection courts have ruled:

A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Regarding Claim 17: Suto et al teach the plasma reactor includes a quartz tube. Further, Yanagisawa et al teach the plasma reactor includes a tube 2 made from aluminum oxide (para. 0049).

Regarding Claim 18: Yanagisawa et al teach gas flow regulators (controllers) 34, 35, 36 which can be adjusted (configured) to adjust flow rates of first and second gases (para. 0050, 0072).

Regarding Claim 19: Admitted prior art in view of Walter et al, Suto et al and Yanagisawa et al teach all limitations of the claim (as already explained above under claim 14) including the apparatus having a process chamber with a wafer to be processed and connected to a plasma via a gas outlet, and where the wafer is exposed to the plasma species generated by the device (Suto et al – Fig. 1). Further, the substrate in the processing chamber of Suto et al (Fig. 1) would be exposed to the gas generated in the plasma generating chamber. Since the prior art apparatus of AAPA in view of Walter, Suto and Yanagisawa is considered capable of generating ClF_3 (as explained above under claim 14), the substrate in the processing chamber is exposed to ClF_3. Additionally since the prior art apparatus meets all the structural limitations of the claim, the same is considered capable of meeting the functional limitation "exposed to gaseous ClF_3".

Regarding Claims 20-22, 27: Admitted prior art in view of Walter et al, Suto et al and Yanagisawa et al teach all limitations of the claim (as already explained above under claim 14) including a method wherein a first gas (e.g. NF_3) and a second gas (e.g. Cl_2) react with one another under the influence of high density plasma (using microwave excitation) to produce ClF_3. Though Walter et al does not teach using high density plasma discharge for producing ClF_3 (besides producing ClF_5), Walter et al teach that besides other factors, relative flow rates of the two gases are controlled to obtain plasma discharge and obtain production of ClF_3 (besides ClF_5). Though Suto et al do not explicitly teach that the method produces chlorine trifluoride, but since Suto teaches production of interhalogen ClF during the process, few molecules of ClF_3

would also be produced during the process, considering the teaching of Walter et al that ClF3 could be produced under glow discharge conditions. Further, since Walter et al teach that process factors like pressure and flow rates of two gases are controlled to obtain glow discharge and produce ClF5, it would be obvious to regulate the flow of first and second gases to obtain optimized (stochiometric) generation of ClF5 (and ClF3) [e.g. Suto et al - Fig. 1 and pages 2032-2034 and Walter et al – col. 3, lines 4-44].

Additionally since the prior art structure of Admitted prior art in view of Walter et al, Suto et al and Yanagisawa et al is equivalent to the applicant's claimed structure, and the claim does not recite any additional process conditions except the selection of relative gas flows, which is also taught by the prior art of Admitted prior art in view of Walter et al, Suto et al and Yanagisawa et al as already explained above, the prior art method teaches all limitations of claim 20 for generation of ClF3 using high density plasma discharge and wherein the ratio of amounts of the two gases are selected to obtain an ideal stoichiometric conversion to ClF3. Examiner also notes that Suto et al uses similar gases viz. Cl2 and NF3 as also used by the applicant to produce ClF3.

Regarding Claims 29, 30: AAPA in view of Walter et al, Suto et al and Yanagisawa et al teach all limitations of the claim (as already explained above under claims 14, 20) including a method for generating chlorine trifluoride including comprising: generating a high-density plasma in a plasma reactor; supplying to the plasma reactor a first gas; supplying to the plasma reactor a second gas; reacting the first gas and the second gas under the influence of the high-density plasma to form chlorine trifluoride in the plasma reactor; transferring the formed chlorine trifluoride to a process chamber assigned to the plasma reactor; and etching a silicone substrate

in the process chamber using the formed chlorine trifluoride as an etching gas. Further, AAPA in view of Walter et al, Suto et al and Yanagisawa et al also teach that amounts of fluorine and chlorine (i.e. the ratio of the amount of the first gas and the amount of second gas) are selected to obtain an optimized stoichiometric conversion to ClF_3 (Suto et al – Fig. 1 and pages 2032-2034, Walter et al – col. 3, lines 4-44 and Yanagisawa et al - Fig. 1 and para. 0044-0053, 0072).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA in view of Walter et al (US 3,354,646), Suto et al (NPL – Highly Selective Etching of Si_3N_4 to SiO_2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) and Yanagisawa et al (US PGPUB No. 2001/0007275) as applied to claims 14, 16-22, 27, 29, 30 and further in view of Ye et al (US 5,756,400).

Regarding Claim 15: AAPA in view of Walter et al, Suto et al and Yanagisawa et al teach all limitations of the claim including a method and apparatus using microwave plasma (high density plasma) apparatus but do not teach the plasma generating means comprise a coil, matching network and a high frequency generator.

Use of a RF coil for generating a high density plasma is known in the art for plasma processing as per reference cited hereunder.

Ye et al teach a method for dry-clean etching of chamber internal surfaces, wherein a first gas (fluorine containing gas) and a second gas (chlorine containing gas) are introduced in a high density inductively coupled plasma reactor comprising a coil 40, matching network 30 and a

high frequency generator 28 (e.g. Fig. 2 and col. 7, line 10 to col. 8, line 5 and col. 11, line 62 to col. 15, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use the plasma generating means including a coil, a matching network and a RF generator as taught by Ye et al in the apparatus and method of AAPA in view of Walter et al, Suto et al and Yanagisawa et al as a known means of generating high density plasma for semiconductor wafer processing.

In this connection courts have ruled:

> The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

Claims 23, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA in view of Walter et al (US 3,354,646), Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) and Yanagisawa et al (US PGPUB No. 2001/0007275) as applied to claims 14, 16-22, 27, 29, 30 and further in view of Mori et al (US 6,136,214).

Regarding Claim 23: AAPA in view of Walter et al, Suto et al and Yanagisawa et al teach all limitations of the claim except oxygen being supplied as an additional gas to plasma reactor or to the process chamber.

Mori et al teach a method for etching silicon oxide film on semiconductor substrates using ClF3 as an etching gas and where oxygen was also supplied as an additional gas (col. 20, lines 5-18).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use oxygen as an additional gas supplied to the process chamber as taught by Mori et al in the apparatus of AAPA in view of Walter et al, Suto et al and Yanagisawa et al for enhancing selective etching of silicon oxide films (column 20, lines 30-38).

Regarding Claim 26: Mori et al teach the plasma density used for etching is around 10.sup.11 -10.sup.12 particles/cm.sup.3 (col. 7, lines 20-30).

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA in view of Walter et al (US 3,354,646), Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) and Yanagisawa et al (US PGPUB No. 2001/0007275) as applied to claims 14, 16-22, 27, 29, 30 and further in view of Ikeda et al (US 6,953,557).

Regarding Claim 24: AAPA in view of Walter et al, Suto et al and Yanagisawa et al teach all limitations of the claim except a filter downstream from the plasma reactor for separating HF.

Ikeda et al teach a method where harmful gases like HF are removed from the etching gases like ClF3 using a removing apparatus (like a filter). Further, these removing apparatus (like stirring tank 5) are installed down stream of the plasma reactor (exhaust line 1) [col.1, lines 15-35 and col. 4, lines 10-60).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use filter for separating/treating gases like HF as taught by Ikeda et al in the apparatus of AAPA in view of Walter et al, Suto et al and Yanagisawa et al to separate out harmful components from the etching gases like ClF3.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA in view of Walter et al (US 3,354,646), Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) and Yanagisawa et al (US PGPUB No. 2001/0007275) as applied to claims 14, 16-22, 27, 29, 30 and further in view of Ye et al (US 5,756,400).

Regarding Claim 25: AAPA in view of Walter et al, Suto et al and Yanagisawa et al teach all limitations of the claim including supply of first gas and a second gas, and such that there is excess of fluorine, but do not teach that the fluoride atoms and chlorine atoms in the form of radicals or reactive species are present in the high density plasma at a 3: 1 ratio.

Ye et al teach a method for dry-clean etching of chamber internal surfaces, wherein a first gas (fluorine containing gas) and a second gas (chlorine containing gas) are introduced in a high density inductively coupled plasma reactor comprising a coil 40, matching network 30 and a high frequency generator 28. Ye et al further teach that fluorine containing gas should be at least 50 % or greater and the chlorine containing gas should be minimum of 10 % to about 50%, which meets the claimed ratio of 3:1 (e.g. Fig. 2 and col. 7, line 10 to col. 8, line 5 and col. 11, line 40 to col. 15, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the fluoride atoms and chlorine atoms in the form of radicals or reactive species being present in the high density plasma at a 3: 1 ratio as taught by Ye et al in the apparatus and method of AAPA in view of Walter et al, Suto et al and Yanagisawa et al to enable form chlorine trifluoride.

Claims 28, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA in view of Walter et al (US 3,354,646), Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) and Yanagisawa et al (US PGPUB No. 2001/0007275) as applied to claims 14, 16-22, 27, 29, 30 and further in view of Yamazaki et al (US 5,641,380).

Regarding Claims 28, 31: AAPA in view of Walter et al, Suto et al and Yanagisawa et al teach all limitations of the claim including that chlorine trifluoride is supplied to a process chamber 1 and that flow rates of first gas and the second gas are controlled to obtain an ideal stoichiometric conversion to ClF3, but do not teach that the flow rate of chlorine trifluoride to the process chamber is greater than 100 sccm.

Yamazaki et al teach a method of etching a substrate in a process chamber wherein chlorine trifluoride is supplied at a flow rate of 500 sccm {col. 6, lines 15-25}. It would have been obvious to supply the chlorine trifluoride from the plasma reactor to the process chamber at a flow rate of 500 sccm (which meets the claim limitation of “greater than 100 sccm”) to enable etch a substrate.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to control the flow rate of chlorine trifluoride as taught by Yamazaki et al in the apparatus of AAPA in view of Walter et al, Suto et al and Yanagisawa et al to enable etch the substrate.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. D./
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1716